

(19) World Intellectual Property Organization
 International Bureau



(43) International Publication Date
 18 September 2003 (18.09.2003)

PCT

(10) International Publication Number
WO 03/077008 A3

(51) International Patent Classification⁷: **G02B 21/24**,
 7/36, 7/38

(21) International Application Number: PCT/IL03/00206

(22) International Filing Date: 13 March 2003 (13.03.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
 148664 13 March 2002 (13.03.2002) IL

(71) Applicant (for all designated States except US): **YEDA RESEARCH AND DEVELOPMENT COMPANY LTD.** [IL/IL]; at the Weizmann Institute of Science, P.O.Box 95, 76100 Rehovot (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KAM, Zvi** [IL/IL]; 38 Hashoftim Street, 64365 Tel Aviv (IL). **GEIGER, Benjamin** [IL/IL]; 3 Hachita Street, 76352 Rehovot (IL).

(74) Agent: **REINHOLD COHN AND PARTNERS**; P.O.Box 4060, 61040 Tel-Aviv (IL).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

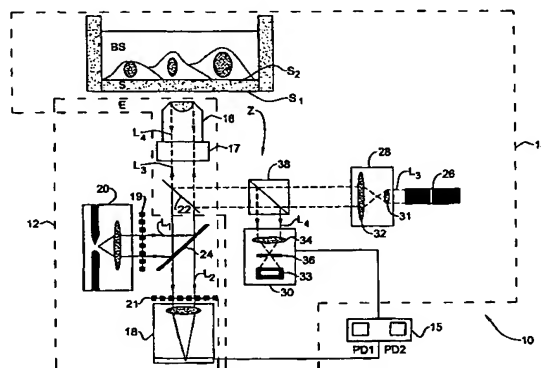
Published:

— with international search report

(88) Date of publication of the international search report:
 18 December 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **AUTO-FOCUSING METHOD AND DEVICE**



(57) Abstract: An auto-focusing method and device are presented for determining an in-focus position of a sample supported on a substrate plate made of a material transparent with respect to incident electromagnetic radiation. The method utilizes an optical system capable of directing incident electromagnetic radiation towards the sample and collecting reflections of the incident electromagnetic radiation that are to be detected. A focal plane of an objective lens arrangement is located at a predetermined distance from a surface of the substrate, which is opposite to the sample-supporting surface of the substrate. A continuous displacement of the focal plane relative to the substrate along the optical axis of the objective lens arrangement is provided, while concurrently directing the incident radiation towards the sample through the objective lens arrangement to thereby focus the incident radiation to a location at the focal plane of the objective lens arrangement. Reflected components of the electromagnetic radiation collected through said objective lens arrangement are continuously detected. The detected reflected components are characterized by a first intensity peak corresponding to an in-focus position of said opposite surface of the substrate, and a second intensity peak spaced in time from the first intensity peak and corresponding to an in-focus position of said sample-supporting surface of the substrate. This technique enables imaging of the sample when in the in-focus position of the sample-supporting surface of the substrate.



WO 03/077008 A3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 03/00206

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G02B21/24 G02B7/36 G02B7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 90796 A (ZHANG HAI ;CHROMAVISION MED SYS INC (US)) 29 November 2001 (2001-11-29) abstract; claim 9; figures 1,2 page 9, line 22 - line 24 ---	1,3,5,6; 8,9,15, 16
X	US 2001/033414 A1 (YAHIRO KANJI) 25 October 2001 (2001-10-25) figures 5A-5D ---	1,3,5,6, 8,9,15, 16
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 157 (P-464), 6 June 1986 (1986-06-06) -& JP 61 011714 A (MATSUSHITA DENKI SANGYO KK), 20 January 1986 (1986-01-20) the whole document --- -/--	1-27

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

2 June 2003

Date of mailing of the international search report

15. 09. 03

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Daffner, M

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/IL 03/00206

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 342 905 A (FUJII NORIO ET AL) 3 August 1982 (1982-08-03) the whole document ---	1-27
A	US 5 783 814 A (FAIRLEY CHRISTOPHER R ET AL) 21 July 1998 (1998-07-21) the whole document ---	1-27
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 474 (P-1117), 16 October 1990 (1990-10-16) -& JP 02 190808 A (NEC CORP), 26 July 1990 (1990-07-26) the whole document -----	1-27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL 03/00206

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-27

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-27

An autofocusing method or device for determining an in - focus position of a sample supported on one surface of a substrate made of a material transparent with respect to incident electromagnetic radiation.

2. Claim : 28

A method for obtaining an image of a three - dimensional sample in the form of a two dimensional projection of a sample supported on one surface of a substrate made of a material transparent with respect to incident electromagnetic radiation.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IL 03/00206

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0190796	A	29-11-2001	US 6518554 B1 AU 6506001 A EP 1285300 A2 WO 0190796 A2	11-02-2003 03-12-2001 26-02-2003 29-11-2001
US 2001033414	A1	25-10-2001	JP 2001296478 A DE 10118156 A1 GB 2362477 A	26-10-2001 25-10-2001 21-11-2001
JP 61011714	A	20-01-1986	JP 1783788 C JP 4062046 B	31-08-1993 05-10-1992
US 4342905	A	03-08-1982	JP 56035111 A JP 62032761 B JP 57037309 A JP 56062217 A	07-04-1981 16-07-1987 01-03-1982 28-05-1981
US 5783814	A	21-07-1998	US 5672861 A US 5483055 A AU 1728495 A WO 9519552 A1 US 5594235 A	30-09-1997 09-01-1996 01-08-1995 20-07-1995 14-01-1997
JP 02190808	A	26-07-1990	NONE	